Introduction

Postherpetic neuralgia (PHN) is a type of neuropathic pain caused by the varicella-zoster virus, which can persist long after the characteristic rash has healed. Patients with PHN often report experiencing burning, sharp, or throbbing pain, as well as altered sensations in the area of the affected dermatome. The diagnosis of PHN is made by taking a patient’s history, which includes the quality of the pain and any episodes of acute herpetic zoster, and through a physical examination that assesses allodynia, hyper- or hyposensitivity to pain, and the presence of cutaneous scarring in the affected area. Pharmacological interventions, such as topical agents, oral analgesics, tricyclic antidepressants, and anticonvulsants, are the primary methods used to manage pain [1].

Perineural injection therapy (PIT) with 5% dextrose in water (SDW) is thought to inactivate transient receptor potential vanilloid receptor-1 (TRPV-1), an important integrator of responses to inflammatory mediators that is found on peripheral nerves [2-4]. This therapy has been used clinically to treat several common entrapment neuropathies, such as carpal tunnel syndrome, radial nerve palsy, and ulnar neuropathy at the elbow [5]. However, to date, there are no case reports on the use of subcutaneous SDW injections for the treatment of PHN. Here, we present three cases of PHN where patients experienced significant improvement following ultrasound-guided subcutaneous injections with SDW.

Case Reports

Ultrasound-guided subcutaneous injections with SDW were administered to patients with PHN. These patients received the injections directly into the affected areas. We retrospectively analyzed the outcomes for these individuals. A summary of all three cases is presented in Table 1.

Increasingly many studies have documented the clinical benefits of perineural injection therapy using 5% dextrose in water for various peripheral entrapment neuropathies. Postherpetic neuralgia is a condition involving chronic neuropathic pain caused by varicella-zoster virus, which may persist for an extended period despite continued treatment. This case series discusses three patients with postherpetic neuralgia who received ultrasound-guided subcutaneous injections with 5% dextrose, resulting in remarkable pain improvement.

Keywords: Glucose; Neuralgia, postherpetic; Injections, subcutaneous

Ultrasound-Guided Subcutaneous Injection with 5% Dextrose for Postherpetic Neuralgia: A Case Series

Min Kyung Park, Dong Hwee Kim

Department of Physical Medicine and Rehabilitation, Korea University College of Medicine, Seoul, Korea

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (http://creativecommons.org/licenses/by-nc/4.0) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Copyright © 2023 Korean Association of EMG Electrodiagnostic Medicine

http://e-jend.org
1) Case 1
A 57-year-old man, previously diagnosed and treated for herpes zoster 3 years prior, presented with chronic tingling and itching pain on the left anterior and posterior chest that had persisted for 1 year. Despite receiving oral analgesics from a local clinic, he experienced no relief. At his initial visit, the patient rated his pain at 5 on a visual analog scale (VAS) and exhibited hypoesthesia to light touch and allodynia within the band-like pain area of the left T4 dermatome (Fig. 1A). Infrared thermography revealed a significantly reduced temperature in the affected left T4 dermatome compared to the contralateral side (Fig. 1B). The patient underwent an ultrasound-guided subcutaneous injection with 5DW totaling 15 cc in the left T4 dermatome (Fig. 1C). Two weeks after the injection, his VAS score decreased to 3, prompting a second 5DW injection of 18 cc. A third 5DW injection was performed 1 month later. At the 1-month follow-up after the third injection, the VAS score had decreased to 1, and there was a significant improvement in allodynia.

2) Case 2
A 68-year-old man, who had been previously diagnosed with herpes zoster 16 months earlier, presented with chronic pain in his right upper buttock. He rated his pain as a 6 on the VAS and reported no allodynia or sensory impairment. A change in cutaneous skin color was observed in the area of pain on the right upper gluteal region. The patient underwent an ultrasound-guided subcutaneous injection with 5DW, totaling 10 cc, in the right buttock (Fig. 1C). Two weeks after the injection, his VAS score decreased to 3, prompting a second SDW injection of 18 cc. A third 5DW injection was performed 1 month later. At the 1-month follow-up after the last injection, the patient’s pain had nearly disappeared.

3) Case 3
A 56-year-old man, previously diagnosed and treated for herpes zoster 2 years prior, presented with chronic pain and itching sensation on the left upper back. He rated his pain as a 5 on the VAS and reported no allodynia or sensory impairment. A change in cutaneous skin color was observed in the area of pain on the left upper back. The patient underwent an ultrasound-guided subcutaneous injection with 5% dextrose in water in the left upper back. Two weeks after the injection, his VAS score decreased to 3. A second injection of 10 cc was administered 3 weeks later. At the 1-month follow-up after the last injection, the patient’s pain had nearly disappeared.

Table 1. Demographic Characteristics and Clinical Findings of Cases

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex/Age (y)</td>
<td>M/57</td>
<td>M/68</td>
<td>M/56</td>
</tr>
<tr>
<td>Chief complaint</td>
<td>Pain, allodynia, and hypoesthesia on the left T4 dermatome</td>
<td>Pain on the right gluteal area</td>
<td>Pain and itching sensation on the left upper back</td>
</tr>
<tr>
<td>Symptom duration (mo)</td>
<td>12</td>
<td>16</td>
<td>24</td>
</tr>
<tr>
<td>Treatment</td>
<td>Oral pain medication</td>
<td>Antiviral agent</td>
<td>Antiviral agent and oral gabapentin</td>
</tr>
<tr>
<td>Initial VAS</td>
<td>VAS 5</td>
<td>VAS 6</td>
<td>VAS 5</td>
</tr>
<tr>
<td>Treatment</td>
<td>Subcutaneous injection of 5DW on the left T4 dermatome</td>
<td>Subcutaneous injection of 5DW on the right gluteal area</td>
<td>Subcutaneous injection of 5DW on the left T5 dermatome</td>
</tr>
<tr>
<td>Follow-up VAS after the first injection</td>
<td>VAS 3</td>
<td>VAS 3</td>
<td>VAS 3</td>
</tr>
<tr>
<td>Follow-up VAS after the second injection</td>
<td>VAS 3</td>
<td>VAS 2</td>
<td>VAS 0</td>
</tr>
<tr>
<td>Follow-up VAS after the third injection</td>
<td>VAS 1</td>
<td>VAS 1</td>
<td>VAS 0</td>
</tr>
</tbody>
</table>

VAS, visual analog scale; 5DW, 5% dextrose in water.

Fig. 1. Sensory changes in the left T4 dermatome (A) and low temperature in the left T4 dermatome (B) compared to the right side one infrared thermography in case 1. Ultrasound-guided subcutaneous injection with 5% dextrose in water on the left T4 dermatome was performed (C). White arrows indicate the needle just below the dermis.
pes zoster 2 years prior, reported chronic throbbing pain in his left upper back that worsened at night. He rated his pain as a 5 on the VAS, and although allodynia was present in the affected area, he retained sensation to light touch and pinprick. Cutaneous lesions were observed in the T5–6 dermatome on the left side of his back. Initially, the patient was prescribed a 2-week course of oral gabapentin, but his pain persisted. Subsequently, he received an ultrasound-guided subcutaneous injection of SDW with a total volume of 5 cc at the left T5 dermatome. Three weeks after the injection, his VAS score decreased to 3, prompting a second injection of SDW, this time with a total volume of 8 cc. Following the third SDW injection (total 5 cc), the patient’s pain and allodynia were completely resolved. Gabapentin was discontinued after the first injection, and the pain remained stably controlled without the need for gabapentin until the two additional injections were administered.

The study protocol received approval from the Institutional Review Board (IRB no. 2022AS0118).

**Discussion**

The pathophysiology of PHN can be partially attributed to the peripheral sensitization of primary afferent neurons. Fields et al. [6] suggested that for a subset of PHN patients who exhibit allostynia and relatively intact sensation, the pain mechanism may be characterized by an “irritable nociceptor.” Pain signals are typically transmitted by unmyelinated C fibers and thinly myelinated Aδ primary afferent neurons. When peripheral nerves are damaged, these neurons may develop pathological ectopic discharges, a reduced threshold for activation by thermal and mechanical stimuli, and an enhanced response to suprathreshold stimulation. These changes contribute to abnormal sensitization and the persistence of chronic neuropathic pain [7]. Experimentally, the in vivo injection of varicella-zoster virus into the footpads of rats has been shown to cause an upregulation of the Na,1.3 and Na,1.8 sodium channel subtypes [8]. This upregulation altered the sodium currents in afferent neurons, facilitating high-frequency ectopic firing that is implicated in neuropathic pain [9].

Various conventional treatments for PHN have been extensively studied and are clinically practiced. Antidepressants, anticonvulsants, opioids, and the lidocaine patch are supported by level A evidence, indicating their efficacy is backed by randomized controlled trials. However, a considerable number of patients find systemic therapy intolerable due to adverse effects, including dizziness, somnolence, and dry mouth.

PIT with SDW for neuropathic pain was first introduced by Lyfogt [10] in 2007. Since then, it has been increasingly utilized to treat a range of peripheral entrapment neuropathies, with its effectiveness supported by a number of studies. For the most common peripheral entrapment neuropathies, carpal tunnel syndrome and ulnar neuropathies at the elbow, this technique has gained acceptance as a standard treatment, with its efficacy confirmed by randomized, double-blind studies. Furthermore, there have been case reports documenting the successful use of PIT with SDW for various entrapment neuropathies, including radial nerve palsy, supinator syndrome, and meralgia paresthetica [5].

In our patients with PHN, ultrasound-guided subcutaneous injections using SDW demonstrated efficacy in managing PHN. This was evidenced by a reduction in the VAS score, with initial scores ranging from 5 to 6 and final scores dropping to between 0 and 1. Notably, no minor or major complications were observed in any of the three cases.

Although the precise mechanism of SDW remains unclear, several potential mechanisms have been proposed. The most widely accepted theory is that SDW mitigates neurogenic inflammation by inhibiting the capsaicin receptor, TRPV-1, in peripheral nerves. TRPV-1 is a non-selective cation channel found in peripheral nociceptors and is implicated in the development of chronic allostynia and neuropathic pain [2]. Petersen et al. [3] observed that the topical application of capsaicin to the skin of patients with PHN significantly exacerbated pain and allostynia. This effect was particularly pronounced in patients with higher pain scores and preserved thermal sensation [3]. Additionally, mannitol, a sugar molecule structurally akin to dextrose, has been shown to alleviate capsaicin-induced pain when applied topically, according to a randomized controlled trial [4].

Building on previous studies that expected PIT with SDW to have an effect on TRPV-1 in peripheral nerves, this study focused on TRPV-1 located at the nerve endings of peripheral sensory nerve fibers. TRPV-1 is predominantly found in unmyelinated C fibers and thinly myelinated Aδ fibers, which are responsible for transmitting pain and temperature sensations. The nerve endings of these fibers are situated in the epidermis and dermis. However, due to the considerable pain associated with dermal injections, this study opted for subcutaneous injections of a sufficient volume of SDW just beneath the dermis. This approach was based on the expectation that the SDW would disperse through the dermis.

In conclusion, ultrasound-guided subcutaneous injection with SDW may be regarded as an effective and safe treatment alternative for patients experiencing persistent PHN that is unresponsive to conventional therapies.
Conflict of Interest

Dong Hwee Kim is an editor-in-chief of the journal. But he was not involved in the peer reviewer selection, evaluation, or decision process of this article. No other potential conflicts of interest relevant to this article were reported.

ORCID

Min Kyung Park, https://orcid.org/0000-0001-6454-0397
Dong Hwee Kim, https://orcid.org/0000-0002-8116-0078

REFERENCES